

## II. 1990 WATER BUDGET FLOW AUGMENTATION

*The Fish and Wildlife Program established a Water Budget volume of 1.19 million acre feet for the Snake River, and 3.45 million acre feet for the Columbia River, to be released during the downstream spring migration of juvenile salmon. The NPPC Program allows the fish passage manager to utilize the Water Budget volumes to maximize juvenile salmonid survival. The objective of the fishery agencies and Indian tribes (A&T) is to maximize protection by attempting to provide migration flows for at least 80% of the spring migration. In order to manage the limited water available for flow augmentation, the fish passage manager utilizes a broad spectrum of information sources related to hydrosystem operations, hydrology, and fish passage, including: (1) historical data bases for flow; (2) historical fish passage data bases; (3) current flow forecasts; (4) current runoff forecasts; (5) projected power and reservoir operations; (6) current hourly spill and flow; (7) current water temperature data; and, (8) current nitrogen saturation monitoring data. The most important information source for Water Budget management is the Smolt Monitoring Program (SMP), which provides fish passage data for Water Budget implementation and a data base for long term evaluation of the Water Budget. The SMP is designed to provide information on several aspects of fish passage, including: (1) passage indices of migration timing and magnitude; (2) fish physiological condition; and, (3) movement and timing of specific mark groups. The SMP addresses interacting variables which affect outmigrant survival, including flow, travel time, predation, water temperature, fish condition, and others. This information provides a basis for the management of Water Budget flows, as provided by the NPPC Program.*

### A. THE 1990 WATER BUDGET COORDINATED PLAN OF OPERATION (CPO)

Section 303(c) of the Program, titled "Coordination of the Water Budget," calls for a meeting by January 15 of each year of "...a committee composed of the fish passage manager, the Council's fish passage advisor, and operators of the power system." Representation on the committee from the power system includes the U.S. Army Corps of Engineers (COE), Bonneville Power Administration (BPA), Pacific Northwest Utilities Conference Committee (PNUCC), mid-Columbia Public Utility Districts (PUD), U.S. Bureau of Reclamation (USBR), and Idaho Power Company (IPC). The committee is named the Water Budget Implementation Work Group (Work Group) and is chaired by the COE.

The primary purpose of the Work Group is to review official runoff forecasts and develop a Coordinated Plan of Operation (CPO) for accounting and use of both the mid-Columbia River and Snake River Water Budgets for the current year. Subsequent meetings are held as needed during February and March. The Program calls for the COE to submit the CPO to the Council by March 20 of each year.

## **1. Negotiating the 1990 Water Budget CPO**

The Work Group held four meetings in the process of developing the 1990 Water Budget CPO: on January 18, February 22, March 2, and March 29. At the first meeting, the COE stated that the 1990 Water Budget CPO should remain essentially the same as the 1989 CPO, with the exception that they would prefer different constraints for the Snake River, so that 85 kcfs would be the target flow and Dworshak Dam would not be required to spill. The COE further indicated that they would have a review CPO draft available before the next Work Group meeting that might incorporate Snake River changes from the 1989 CPO. The January water supply outlook indicated that 1990 would be a below average runoff year, but there was more water in storage than at this time in 1989.

Water supply forecasts available at the second Work Group meeting, held on February 22, showed improvement in runoff volumes over the January forecasts. Some reservoir drafting would be necessary to meet mid-April flood control rule curves. This action was expected to impact streamflows and the timing and magnitude of Water Budget requests, and were considerations in developing the CPO.

The draft 1990 Water Budget CPO, provided by the COE before the second meeting, was mostly unchanged from 1989 except for operation of Dworshak Dam to provide the Water Budget. Because agreement could not be reached on the COE proposed operational constraints for Dworshak Dam, it was agreed that each entity would provide written comments on the COE draft CPO, followed by another meeting prior to the next Mainstem Executive Committee (MEC) meeting, to see if an understanding could be reached by the Work Group, or if the issue should be elevated to the MEC. The MEC is a committee consisting of representatives from the state and federal fish and wildlife agencies, Indian tribes, USBR, COE, BPA, and PNUCC, which was established in 1987 to address major policy issues relating to mainstem fish passage. The USBR and PNUCC representatives indicated that their agencies probably would not comment in writing on this issue.

The third Work Group meeting was held on March 2, 1990, specifically to address Water Budget releases from Dworshak reservoir. Written comments which had been received from the FPC and NPPC were discussed. In addition, BPA comments, still in preparation, were summarized verbally by the BPA representative. The following box summarizes those three sets of comments.

### **BPA comments focused on three issues:**

- Mid-Columbia Water Budget flow requests should not exceed 140 kcfs, measured as outflow at Priest Rapids Dam.
- Lower river target flow requests should not be allowed.
- An 85 kcfs target flow cap at Lower Granite Dam should be a CPO stated flow constraint.

**NPPC comments focused on the Snake River Water Budget, and provided specific language for operation of Dworshak Dam:**

- The Fish and Wildlife Program allows for Water Budget requests for flows up to 140 kcfs at Lower Granite Dam.
- The COE and BPA have the responsibility to decide how to provide flows from Dworshak and Brownlee dams to fulfill Water Budget requests.
- Dworshak Dam releases up to 25 kcfs should be allowed to meet Water Budget requests.
- The decision to release more than 10 kcfs from Dworshak Dam should be made by the COE on a case-by-case basis considering non-power impacts.
- In accordance with the NPPC priority recommendations for competing uses of the hydropower system (section 303(a)(8) of the Fish and Wildlife Program), water budget volumes should take priority over reservoir refill from April 15 through June 15.

**FPC comments reiterated recommendations made for the 1989 CPO, which were still believed to be essential to adequately protect the juvenile fish outmigration; the FPC proposed specific language for operation of Dworshak Dam:**

- A common fishery objective should be adopted to protect at least the middle 80% of the juvenile outmigration.
- The Snake River accounting system should be utilized in the Columbia River by measuring Water Budget use as the outflow increases required at Grand Coulee to meet Water Budget requests.
- A sliding scale should be adopted to define guaranteed power base flows at both Priest Rapids and Lower Granite dams.
- Reservoir refill should be a lower priority than providing flows for fish.
- A larger Water Budget volume commitment from Dworshak Dam should be provided and the sliding scale that drops to zero in above average runoff years eliminated.
- Flow changes outside the Water Budget period that create low flow conditions unfavorable to fish should be minimized.
- For Dworshak Dam operations,
  - Water Budget requests can be made for flows up to 140 kcfs at Lower Granite Dam up to a release of 25 kcfs from Dworshak Dam;
  - Dworshak Dam discharges in excess of 10 kcfs will be provided based on COE case-by-case evaluation of non-power impacts; and
  - Flows beyond the Water Budget commitment may be provided from Dworshak Dam if refill is not jeopardized.

A revised draft for Dworshak Dam operation (CPO Section 6(a)(3)), giving consideration to applicable comments cited above, was presented by the COE. The revised language dropped the reference to 85 kcfs as a target flow at Lower Granite Dam, and allowed for flows above 10 kcfs at Dworshak Dam, which requires spill, on a case-by-case basis. This revised draft was acceptable to the Work Group representatives.

## **2. The Final 1990 Water Budget CPO**

The final 1990 meeting of the Work Group was held on March 22 to review water supply and refill projections, and the final 1990 Water Budget CPO draft. The latest runoff forecast (March mid-month) indicated near normal April-July runoff at The Dalles Dam, comprised of a little above average from the mid and upper Columbia River drainage, but substantially below average from the Snake River drainage. Some reservoirs were drafting for flood control but, with continued dry weather in March, it was expected that flood control requirements probably would be relaxed at most reservoirs.

The revised 1990 Water Budget CPO, which incorporated the language on Dworshak Dam releases agreed to at the March 2 meeting, was distributed for comment. This final draft by the COE was unchanged from the 1989 Water Budget CPO, except for the aforementioned Dworshak Dam operations changes, which means that all other recommendations by other Work Group members were rejected by the COE. No further comments were offered, and this CPO version was later transmitted to the NPPC and other involved parties as the final 1990 Water Budget CPO (see Appendix A for the full text). In its transmittal letter to the FPC, dated April 10, 1990, the COE stated that issues involved in the other CPO additions and modifications recommended by the FPC would be best resolved at a policy-level forum.

### **B. 1990 RUNOFF**

The Northwest Power Planning Council's Fish and Wildlife Program 303(c)(3) requires this report to include:

1. *The actual flows achieved for the calendar year;*
2. *A record of the estimated number of smolts that passed Lower Granite and Priest Rapids dams, and the period of time over which the migration occurred; and*
3. *A description of the flow shaping used for the calendar year to achieve improved smolt survival.*

Each of these activities is dependent upon the magnitude and timing of natural runoff from the previous winter's snowpack, operation of storage reservoirs (including Water Budget flow augmentation), and the amount and distribution of precipitation during the runoff period. The following is a discussion of the 1990 runoff and precipitation and a brief discussion of the resultant streamflows. A more thorough discussion of streamflows appears later in this report.

## 1. Runoff Volumes

Two different periods of record are used in comparing historical runoff averages with current year averages. Power planning in the Pacific Northwest and some other hydrological analyses are based upon "critical" low periods of runoff. For these purposes, therefore, a 50-year record from 1929-78 is used in order to incorporate the critical runoff years of the 1930's and 1940's.

According to the Northwest River Forecast Center (NWRFC) of the National Weather Bureau, the 25-year period of 1961-85 has been adopted for runoff forecasts and precipitation comparisons. This is based on the premise that the shorter period more accurately reflects the present, worldwide weather cycle. The NWRFC intends to add another five years after 1990 data becomes available. Thereafter, a moving 30-year average will be used, updated in 5-year increments.

Since the 25-year period now in use does not include the very dry years in the 1930's and 40's, averages for this shorter period range from 3 to 7% higher than for the 50-year period. To be consistent with accepted reporting practices, this report uses the 50-year period in comparing observed runoff volumes, and the 25-year period in comparing runoff forecasts and precipitation.

Table 1 provides comparisons of the 1990 January through July (Jan-Jul) runoff volumes in million acre-feet (MAF), adjusted for upstream storage and diversions, in the Snake, mid-Columbia, and lower Columbia rivers with the 50-year (1929-78) averages. System runoff in 1990 as measured at The Dalles Dam was 98% of the 50-year average. This ranks 1990 as comparable to 30th out of 50 years in Jan-Jul runoff volume.

**Table 1. January-July runoff comparisons.**

Location	50-Year Average (MAF)	1990 Adjusted (MAF)	1990 % of 50-Yr. Average	1990 Rank (1928-78)
The Dalles Dam	101.7	99.7	98	30
Rock Island Dam	68.7	74.7	109	16
Lower Granite Dam	28.1	20.2	72	40

The January-July runoff was 109% of the 50-year average (rank 16) in the mid-Columbia River as measured at Rock Island Dam, but the Snake River produced only 72% of the 50-year average (rank 40) at Lower Granite Dam. This illustrates that, although the total runoff was near average, the percentage of 1990 runoff contribution to lower Columbia flows was much less than the 50-year average for the Snake compared to the mid-Columbia.

## 2. Runoff Forecasts

Runoff forecasts are made each month beginning in January by selected members of the Columbia River Water Management Group, with the April forecast designated as the "official" runoff forecast for the year. The March forecast, however, is the latest available to work with for



developing the final CPO for the season's Water Budget implementation.

Each monthly runoff forecast assumes that normal precipitation will occur throughout the duration of the forecast period. The following two tables compare the effect of departures from normal precipitation on month-to-month runoff forecasts. Table 2 compares the 1990 month-to-month Jan-Jul runoff forecasts with the 1961-85 average runoff at selected locations in the Snake, mid-Columbia, and lower Columbia rivers. Table 3 compares 1990 observed monthly precipitation with the normal (1961-85 average) for each month for comparable runoff areas.

**Table 2. 1990 Forecasted vs. average (1961-85) January-July runoff.**

JAN-JUL RUNOFF	ROCK ISLAND		LOWER GRANITE		THE DALLES	
	<u>kaf</u>	<u>% of Ave.</u>	<u>kaf</u>	<u>% of Ave.</u>	<u>kaf</u>	<u>% of Ave.</u>
1961-85 Ave.	70,690		31,060		108,700	
<u>MONTHLY FORECAST:</u>						
January	64,200	91	19,100	62	86,500	80
February	74,800	106	22,600	73	101,000	93
March	76,000	108	23,500	76	104,000	96
April	72,300	102	19,900	64	96,000	88
May	73,200	104	19,600	63	96,000	88
June	<u>76,100</u>	<u>108</u>	<u>20,700</u>	<u>67</u>	<u>99,500</u>	<u>92</u>
Adjusted	74,700	106	20,200	65	99,700	92

Table 2 shows a sizable increase in forecasted runoff volume between the January and February forecasts for each location. This corresponds with the Table 3 listing of precipitation well above normal for each watershed in January, which would lead to an increased runoff forecast for the following month. The decrease in the April forecasted runoff volume at each location (Table 2) reflects that March was a very dry month throughout the basin (Table 3). Above normal precipitation from May through August in the Columbia drainage above Grand Coulee Dam was balanced by below normal precipitation in the Snake drainage, resulting in precipitation for the entire basin above The Dalles Dam totaling about 100% of normal by the end of August. A very dry September in all areas dropped the water year total (Oct 1989-Sept 1990) to 96% of normal for the Columbia above The Dalles Dam.

**Table 3. 1990 Observed vs. average (1961-85) monthly precipitation.**

MONTH	Col. above Coulee		Col. above TDA		Upper Snake		Snake above IHR	
	<u>inches</u>	<u>% of Ave.</u>	<u>inches</u>	<u>% of Ave.</u>	<u>inches</u>	<u>% of Ave.</u>	<u>inches</u>	<u>% of Ave.</u>
January	4.03	124	3.77	122	1.98	82	2.54	103
February	2.27	98	2.17	99	1.49	81	1.58	89
March	0.96	52	1.23	64	0.93	54	1.27	70
April	1.53	94	2.04	124	2.41	143	2.33	142
May	3.71	181	3.07	171	2.11	95	2.64	149
June	2.81	117	1.93	100	1.14	50	1.10	61
July	1.92	127	1.20	113	0.71	56	0.77	90
August	2.02	121	1.58	125	0.78	54	1.07	102
September	<u>0.19</u>	<u>11</u>	<u>0.31</u>	<u>21</u>	<u>1.46</u>	<u>83</u>	<u>0.50</u>	<u>38</u>
Water Year:								
Oct-Sept.	28.04	104	23.27	96	16.65	74	17.04	82

A graphical comparison of how forecasted runoff varied from what actually occurred at Rock Island, Lower Granite, and The Dalles dams is shown in Figure 1. The numbers at the top of each adjusted<sup>1</sup> volume bar represent the percentage of the 25-year average runoff, also shown, that occurred in 1990 during each runoff period. Note that the runoff volumes illustrated in Figure 1 are the remaining runoff volumes from the forecast month through July, whereas the forecasts in Table 2 are for the Jan-Jul period updated each month. Recall that the March forecasts in Table 2 was used in preparing the CPO, because the observed runoffs in Figure 1 can only be determined after-the-fact. Forecasts for residual runoff in Figure 1, together with the month-by-month magnitude and departure of forecasted runoff from runoff that actually occurs, and the storage status of the system reservoirs have the greatest influence on the degree of in-season system operational flexibility available to meet the needs of migrating juvenile fish.

The percentage values illustrate that, for the six runoff periods, adjusted runoff ranged between 100-107% of average in the mid-Columbia River, 60-66% in the Snake River, and 90-92% in the lower Columbia River. These closely parallel the effect of monthly precipitation departures from normal, especially the above average months in the upper Columbia River watershed and below average months in the Snake River watershed.

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<sup>1</sup> observed volume adjusted for upstream storage.

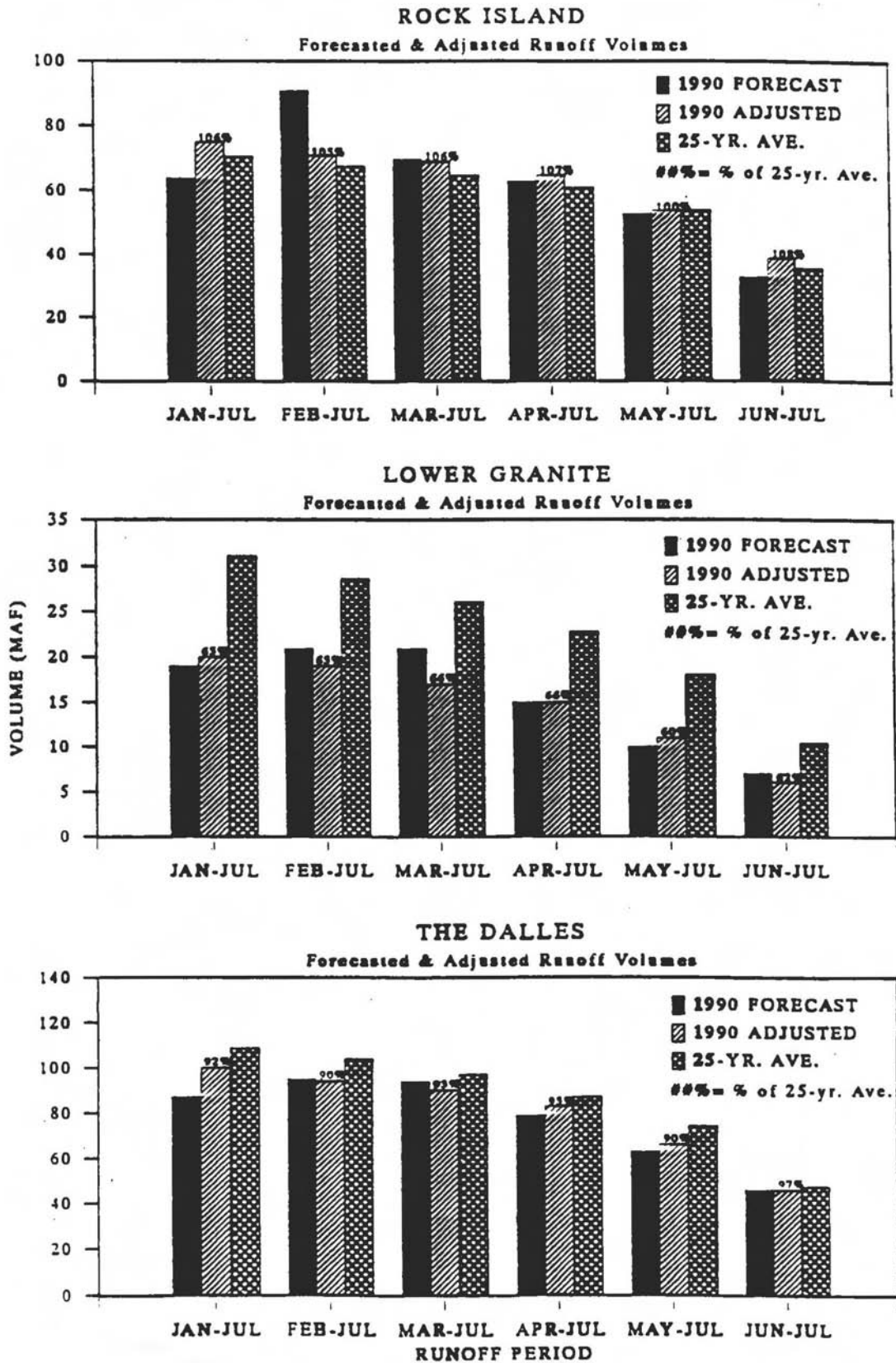


Figure 1. 1990 Forecasted and observed runoff volumes, and the 25-year average in the mid-Columbia, Snake, and lower Columbia River reaches.